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Placental Location and Fetomaternal Outcomes in a Tertiary-Care Center

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Abstract

Background: Placental implantation site may influence uteroplacental perfusion and has been linked to hypertensive disorders, PPROM, fetal growth restriction, and delivery outcomes, warranting systematic evaluation of fetomaternal risks by placental location.

Objective: To determine the association between placental location (anterior, posterior, lateral), maternal complications and fetal/neonatal outcomes in singleton pregnancies managed at a tertiary-care hospital.

Methods: We conducted a prospective observational study of singleton pregnancies, classifying participants into anterior, posterior, and lateral placental-location groups by real-time trans-abdominal ultrasonography (1–5 MHz curvilinear probe). Analyses were conducted in Stata v17.

Results: Among 110 pregnancies, placental location was anterior in 49 (44.5%), posterior in 42 (38.2%), and lateral in 19 (17.3%). Baseline characteristics were comparable across groups (age 26.9–27.4 years, BMI 23.7–24.1 kg/m², gravidity 2.0–2.1; all p>0.05). Maternal morbidity varied by location: lateral placentation showed higher number of hypertensive disorders (68.4%) versus anterior (16.3%, 4.1%) and posterior (16.7%, 7.1%), with significant differences (p=0.044; p=0.014). Conversely, PPROM/PROM was more frequent with anterior placentas (28.6%) than posterior (9.5%) or lateral (10.5%; p=0.040). Other maternal outcomes—including malpresentation, PPH, and caesarean delivery—did not differ significantly (all p>0.05). Fetal metrics were less favourable with lateral placentas: mean gestational age was lower (37.5±1.4 weeks vs 38.6±1.3 anterior, 38.5±1.4 posterior; p=0.005) and birth weight was reduced (2700.0±480.0 g vs 2980.0±420.0 and 3020.0±410.0; p=0.001).

Conclusion: Placental location had an independent impact on fetomaternal outcomes-while anterior placentation was associated with a greater risk of PROM and PPROM, lateral placentation correlated with higher rates of hypertensive disorders and lower gestational age and birth weight. These results emphasize the need for individualized antenatal monitoring and tailored delivery planning based on placental position.

Keywords: Placental location, Anterior placenta, Posterior placenta, Lateral placenta, Fetomaternal outcomes

Introduction

Placental implantation and its functional integrity are fundamental to the establishment of effective uteroplacental circulation and optimal pregnancy outcomes. The placenta serves as the critical interface between the mother and fetus, ensuring adequate transfer of oxygen, nutrients, and metabolic waste. Any alteration in its development or site of implantation can influence vascular remodeling and placental perfusion, thereby affecting maternal adaptation to pregnancy and fetal growth. Understanding placental dynamics is therefore central to anticipating and managing obstetric complications.

Placental location, routinely assessed during obstetric ultrasonography, has emerged as a simple and non-invasive marker with potential prognostic significance. Variations in the site of placental attachment may reflect differences in trophoblastic invasion and uterine vascular adaptation. Increasingly, placental localization is being explored not merely as an anatomical observation but as a clinical parameter that may help predict adverse maternal and perinatal outcomes. This holds particular importance in routine antenatal care, where early identification of at-risk pregnancies can guide surveillance and intervention strategies.

Recent evidence highlights the association between placental position—especially lateral implantation—and altered uterine artery blood flow. Such changes may contribute to impaired placentation and the development of hypertensive disorders of pregnancy. Inadequate perfusion resulting from asymmetric vascular supply has also been linked to complications such as fetal growth restriction, preterm birth, and other adverse perinatal outcomes. These associations underscore the need to better understand placental topography as a functional determinant rather than a purely descriptive finding.

In this context, the present study aims to evaluate the relationship between placental location and maternal–fetal outcomes in singleton pregnancies. By examining this association, the study seeks to contribute to the growing body of evidence on the clinical relevance of placental localization and its potential role as an early, accessible predictor of obstetric risk. Such insights may aid in refining antenatal risk stratification and improving both maternal and neonatal health outcomes.

Materials and Methods

This was a single centre, hospital-based, observational, analytical study – prospective follow-up design – conducted in the antenatal outpatient department and/or inpatient wards of the Department of Obstetrics and Gynaecology, Rajarajeswari Medical College and Hospital, Bangalore, Karnataka, India over a period of six months between March 2025 and August 2025. The participants were given the Participant Information Sheet (PIS) in their native language, and its contents were verbally explained to ensure their understanding and satisfaction. Enrolment into the study proceeded upon receipt of written informed consent. Pregnant women with singleton pregnancy, greater than 18 weeks of gestation were included in the study. However, women with known comorbidities prior to pregnancy; multiple pregnancy; gross placental or umbilical cord abnormalities; known uterine as well as fetal congenital malformations; and known case of placenta previa were excluded.

Sample size was planned for a chi-square comparison of adverse-outcome proportions across three placental-location groups with α=0.05 and power=80%, assuming Cohen's w=0.31.

Data were collected prospectively, and participants were divided into three groups based on placental location determined by ultrasonography: Group A comprised women with an anterior placenta, Group B comprised those with a posterior placenta, and Group C comprised women with lateral placentas (right or left). For each participant, a detailed maternal history was documented, including age, height, pre-pregnancy weight, obstetric history, and past medical or surgical conditions; a general physical, systemic, and obstetric examination was also performed. Data collection utilized a standardized case-reporting form, real-time ultrasonography, and laboratory investigations. Placental location was ascertained using trans-abdominal ultrasound with a 1–5 MHz biconvex (curvilinear) probe. Laboratory investigations included routine haemograms, thyroid-stimulating hormone (TSH) levels, urine routine microscopy, and a glucose challenge test, with liver and kidney function tests obtained where clinically indicated. Maternal outcomes assessed included the incidence of hypertensive disorders of pregnancy, gestational diabetes mellitus, preterm premature rupture of membranes (PPROM), threatened preterm labour, premature rupture of membranes (PROM), malpresentation, postpartum haemorrhage. Fetal outcomes evaluated included birth weight, intrauterine growth restriction (IUGR), intrauterine fetal death, stillbirth, and the need for neonatal intensive care unit (NICU) admission.

Statistical analysis

Statistical analyses were performed using two-sided tests with a significance threshold of α=0.05. Continuous variables were inspected for normality (Shapiro–Wilk) and homoscedasticity (Levene's test); normally distributed measures were compared across placental-location groups using one-way ANOVA with Bonferroni-adjusted post-hoc contrasts, while skewed data were analysed with the Kruskal–Wallis test and Dunn's post-hoc procedure. Categorical outcomes were compared using χ^2 tests of independence, or Fisher's exact test when expected cell counts were <5. Summary statistics were presented as mean (SD) or n (%). Analyses were conducted in Stata v17.

Results

The distribution of placental location in this cohort (N=110) showed anterior in 49 (44.5%), posterior in 42 (38.2%), and lateral in 19 (17.3%).

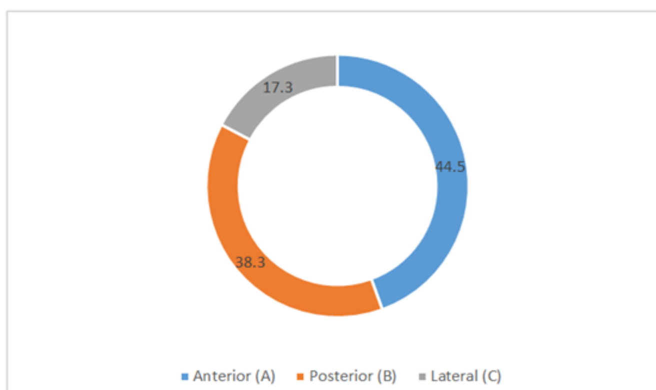

Figure 1: Distribution of participants by placental location (N = 110)

Maternal outcomes varied by placental site (Table 1). Lateral placentation was associated with a higher prevalence of hypertensive morbidity (p=0.0003). Conversely, anterior placentation demonstrated a greater frequency of membrane-related complications, specifically PPROM/PROM (14/49, 28.6%; p=0.040). Rates of malpresentation (≈9.5–10.5%; p=0.991), postpartum haemorrhage (≈2.4–5.3%; p=0.835), and caesarean delivery (36.7% anterior, 33.3% posterior, 57.9% lateral; p=0.172) did not differ significantly.

Table 1: Maternal outcomes by placental location (N = 110)

Maternal outcome	Anterior (A)	Posterior (B)	Lateral (C)	p value
	N = 49	N = 42	N = 19	
Hypertensive disorders of pregnancy, n(%)	10 (20.4)	10 (23.8)	13 (68.4)	0.0003*
GDM, n (%)	6 (12.2)	5 (11.9)	3 (15.8)	0.907
PPROM/PROM, n (%)	14 (28.6)	4 (9.5)	2 (10.5)	0.040*
Threatened preterm labour, n (%)	6 (12.2)	5 (11.9)	5 (26.3)	0.278
Malpresentation, n (%)	5 (10.2)	4 (9.5)	2 (10.5)	0.991
Postpartum haemorrhage, n (%)	2 (4.1)	1 (2.4)	1 (5.3)	0.835
Caesarean delivery, n (%)	18 (36.7)	14 (33.3)	11 (57.9)	0.172
*Statistically significant at p<0.05				

Fetal and neonatal outcomes differed by placental location (Table 2). Categorical outcomes showed consistent but non-significant trends: IUGR occurred in 6/19 (31.6%) lateral pregnancies versus 6/49 (12.2%) anterior and 5/42 (11.9%) posterior (p=0.102); NICU admissions were 6/19 (31.6%) lateral, 8/49 (16.3%) anterior, and 6/42 (14.3%) posterior (p=0.242). Rates of IUFD/stillbirth (0–5.3%; p=0.089) were low and did not differ significantly.

Table 2: Fetal/neonatal categorical outcomes by placental location (N = 110)

Fetal/neonatal outcome	Anterior (A)	Posterior (B)	Lateral (C)	p value
	N = 49	N = 42	N = 19	
IUGR, n (%)	6 (12.2)	5 (11.9)	6 (31.6)	0.102
IUFD/Stillbirth, n (%)	0 (0.0)	0 (0.0)	1 (5.3)	0.089
NICU admission, n (%)	8 (16.3)	6 (14.3)	6 (31.6)	0.242
*Statistically significant at p<0.05				

Discussion

In this cohort, anterior (44.5%), posterior (38.2%), and lateral (17.3%) placental locations approximated distributions reported in Alakonda et al. (2023) in which anterior/posterior sites predominate and lateral placements are least frequent.

The most notable maternal signal was the excess of hypertensive morbidity with lateral placentation, consistent with Kofinas et al. (1989) linking lateral implantation to asymmetric uterine perfusion and higher uterine artery resistance.[4] Mechanistically, a laterally situated placenta relies predominantly on ipsilateral uterine arterial supply with limited contralateral contribution, potentially elevating placental vascular resistance and predisposing to the cascade of impaired spiral artery remodelling, placental hypoxia, and antiangiogenic imbalance that characterizes preeclampsia, as noted by Murali et al. (2023).[13] Meta-analytic summaries Naik et al. (2022) and Siargkas et al. (2023) likewise report increased risks of preeclampsia, small for gestational age (SGA)/fetal growth restriction (FGR), and preterm birth when the placenta is lateral, supporting our finding of higher gestational hypertension and preeclampsia in Group C.[5, 14]

The higher frequency of PPROM/PROM among women with anterior placentas in our data aligns with reports including Aggarwal et al. (2025) that anterior implantation can influence membrane stress and obstetric management, although literature is mixed and mechanisms are less well formalized than for laterality.[16] Proposed explanations include altered uterine contour dynamics and regional variations in chorion–decidua tensile properties over the anterior wall, but robust biomechanical corroboration remains limited and warrants targeted study.[12] Other maternal outcomes—malpresentation, postpartum haemorrhage, and mode of delivery—did not differ significantly, which mirrors Devarajan et al. (2012) showing that many routine obstetric endpoints are not consistently modified by placental site once major confounders are accounted for.[17]

Fetal and neonatal findings add biological plausibility to the maternal signals. Observational syntheses report that lateral placentas carry higher risks of FGR/SGA and preterm birth, with effect estimates that, while variable, generally favour a clinically meaningful association; our continuous outcomes (gestational age and birth weight) therefore fit within the expected directionality.[5] Still, contradictory data exist; Devarajan et al. (2012) have found no significant differences in newborn weight or composite perinatal outcomes by placental location, highlighting residual confounding, differing definitions of 'lateral,' and gestational-age windows of ultrasound ascertainment as potential sources of discrepancy.[17]

Categorical neonatal endpoints—higher but non-significant rates of IUGR and NICU admission in the lateral group—are directionally consistent with the continuous measures yet likely underpowered at our sample size, a limitation frequently noted in single-centre analyses of placental site where lateral cases are relatively few.[5] The isolated occurrence of stillbirth in the lateral group in our series cannot be interpreted causally, but it is compatible with the general principle that placental dysfunction—more likely when uteroplacental flow is compromised—raises the risk of adverse perinatal endpoints.[18]

Taken together, these findings reinforce the clinical utility of documenting placental site during routine mid-trimester ultrasonography.[19] Identification of lateral placentation may justify heightened surveillance for hypertensive disorders and fetal growth, with selective use of uterine artery Doppler to refine risk where resources permit.[4] For anterior placentation, vigilance for membrane complications such as PPROM/PROM could be considered, pending confirmation from larger prospective cohorts that precisely define anterior vs fundal placements and adjust for cervical length and infection risk.[16] From a pathophysiological perspective, our results fit a coherent model in which the geometric relationship between placental bed and uterine vasculature governs the efficiency of maternal–fetal exchange, thereby modulating risks of preeclampsia, growth restriction, and prematurity.

This single-centre, observational study had several limitations that may affect interpretation. First, the modest sample size (N=110) and particularly the small lateral group (n=19) reduced statistical power for less common outcomes and increased imprecision of estimates, raising the possibility of type II error. Second, placental location was classified on routine trans-abdominal ultrasonography without formal inter-observer reliability testing; fundal and anterofundal/posterofundal positions were not analysed separately, and uterine artery Doppler was not uniformly incorporated, which may have led to exposure misclassification and residual confounding by placental perfusion. Third, although baseline characteristics were comparable, unmeasured confounders (e.g., socioeconomic status, smoking, aspirin use, cervical length, subclinical infection) were not systematically captured or adjusted. Finally, as an observational design from a tertiary-care setting, causal inference is limited and generalisability beyond similar contexts may be constrained.

Conclusion

Our study shows the correlation between the placental location and the maternal complications, in which, lateral placentation was associated with higher hypertensive morbidity and earlier, lower-birth-weight deliveries, whereas anterior placentation showed greater PPROM/PROM. Accordingly, incorporating placental location into routine risk stratification may enhance antenatal surveillance and help reduce maternal morbidity and mortality, making it a valuable predictor of obstetric complications.

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